Движение тела, брошенного под углом к горизонту с учётом сопротивления воздуха

$k := 0.2 \quad \alpha := 50° \quad steps := 20$

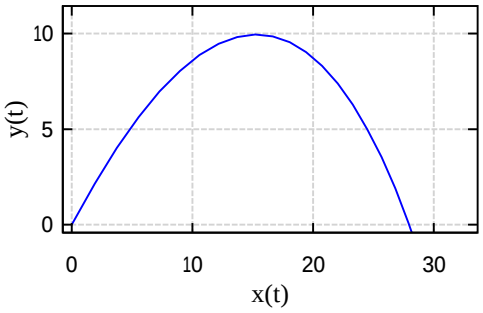
$v_0 := 20 \quad m := 1 \quad g := 9.8 \qquad \text{appVersion}(3) = \text{"1.2.9018"}$

Вариант 1

$D(t, u) := \text{stack}\left(u_3, u_4, -k \cdot \frac{u_3}{m}, -g - k \cdot \frac{u_4}{m}\right)$

$u_0 := \text{stack}(0, 0, v_0 \cdot \cos(\alpha), v_0 \cdot \sin(\alpha))$

$u := \text{rkfixed}(u_0, 0, 3, steps, D)$



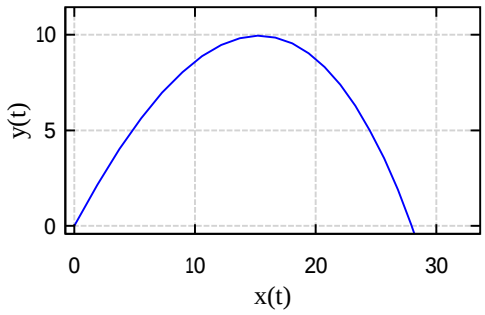
$\text{rkfixed}("?") =$
```
"rkfixed(cmd)
rkfixed(ode,y(x),xmax)
rkfixed(ode,y(x),xmax,steps)
rkfixed(ics,xmin,xmax,steps,D(x,y))"
```

$u_{[1..\text{rows}(u)]\begin{bmatrix}2\\3\end{bmatrix}}$

Вариант 2 $\text{Clear}(t, u, x(t), y(t), vx(t), vy(t)) = 1$

$$\begin{cases} x(0) = 0 \quad y(0) = 0 \\ vx(0) = v_0 \cdot \cos(\alpha) \\ vy(0) = v_0 \cdot \sin(\alpha) \\ x'(t) = vx(t) \\ y'(t) = vy(t) \\ vx'(t) = -k \cdot \frac{vx(t)}{m} \\ vy'(t) = -g - k \cdot \frac{vy(t)}{m} \end{cases}$$

$t := \text{col}(u, 1)$



$\begin{bmatrix} x(t) \\ y(t) \end{bmatrix}$

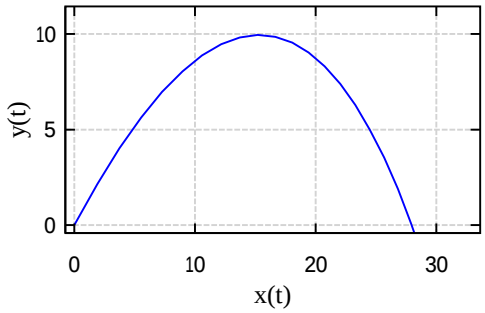
$\text{var2str}\left(\begin{bmatrix} x(t) \\ y(t) \end{bmatrix}\right) = \text{"mat(x(~t),y(~t),2,1)"}$

$$u := \text{rkfixed}\left(\begin{cases} x(t) \\ y(t) \\ vx(t) \\ vy(t) \end{cases}, 3, steps\right)$$

Вариант 3 $\mathrm{Clear}(t, u, x(t), y(t), vx(t), vy(t)) = 1$

$$\begin{cases} x(0) = 0 \quad y(0) = 0 \\ x'(0) = v_0 \cdot \cos(\alpha) \\ y'(0) = v_0 \cdot \sin(\alpha) \\ x''(t) = -k \cdot \dfrac{x'(t)}{m} \\ y''(t) = -g - k \cdot \dfrac{y'(t)}{m} \end{cases}$$

$t := \mathrm{col}(u, 1)$



$u := \mathrm{rkfixed}\left(\begin{pmatrix} x(t) \\ y(t) \end{pmatrix}, 3, \mathrm{steps}\right)$

$\begin{bmatrix} x(\mathbf{t}) \\ y(\mathbf{t}) \end{bmatrix}$

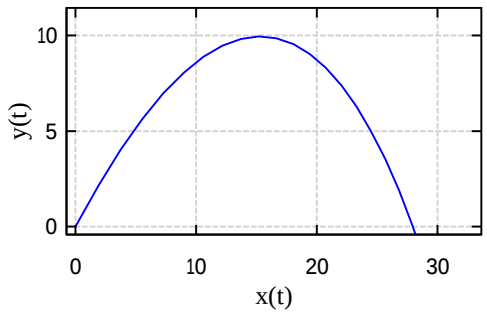
$\mathrm{var2str}\left(\begin{bmatrix} x(\mathbf{t}) \\ y(\mathbf{t}) \end{bmatrix}\right) = \text{"mat(x(~t),y(~t),2,1)"}$

Вариант 4 $\mathrm{Clear}(t, u, x(t), y(t), vx(t), vy(t)) = 1$

$$ode := \begin{cases} x(0) = 0 \\ y(0) = 0 \\ x'(0) = v_0 \cdot \cos(\alpha) \\ y'(0) = v_0 \cdot \sin(\alpha) \\ x''(t) = -\dfrac{k \cdot x'(t)}{m} \\ y''(t) = -\dfrac{g \cdot m + k \cdot y'(t)}{m} \end{cases}$$

$u := \mathrm{rkfixed}\left(ode, \begin{pmatrix} x(t) \\ y(t) \end{pmatrix}, 3, steps\right)$

$t := \mathrm{col}(u, 1)$



$\begin{bmatrix} x(\mathbf{t}) \\ y(\mathbf{t}) \end{bmatrix}$

$\mathrm{var2str}\left(\begin{bmatrix} x(\mathbf{t}) \\ y(\mathbf{t}) \end{bmatrix}\right) = \text{"mat(x(~t),y(~t),2,1)"}$